

Music Printing: An Update

Music printing was the major focus of the 1986 *Directory*. The main approaches to computer-based music printing were examined, and two dozen examples from diverse systems were presented. The continued growth of interest in this field has encouraged us to present a new series of examples this year; for an overview of the field, readers should consult the previous volume. The majority of music printing contributions in the current *Directory* are either from systems that have not been represented before or have increased their capabilities since they were last shown.

We have separated contributions into four categories: (1) proprietary systems, (2) commercial systems, (3) software for printing music, and (4) user contributions. All examples in the first three categories were contributed by system developers, whose names are given in parentheses. User contributions may not show off a system's capabilities to best advantage, in that the hardware used may be quite basic; conversely, patient users sometimes extract mileage from particular systems with which they have become highly familiar that developers have failed to display. Proprietary systems are not available for sale. Commercial systems are for sale but require the purchase of dedicated hardware as well as software. The software category represents programs specifically devoted to music printing that run on widely available microcomputers. Potential users should check with developers (whose addresses are listed in the back of this volume) to determine what specific hardware configurations (including memory requirements, graphics cards, interfaces, etc.) may be necessary for their programs.

To facilitate comparison of systems, we distributed a set of musical examples to all the software developers on our mailing list. These examples -- a Bach chorale, the opening bars of a Bach harpsichord prelude, and excerpts from Mozart's clarinet quintet -- were selected to elicit information both about music printing capabilities and about music representation and file structures. The original examples are represented by the first three pages of music shown (Toppan Scan-Note System). For music printing, some particular areas of interest were text underlay and basso continuo figuration (Ex. 1), subtleties of part differentiation, slurs, and fingering (Ex. 2), and accurate representation of transposing parts and ornamentation (Ex. 3). A fourth example was one with no notable printing complexities and has not been reproduced in the printing section. Several developers contributed their versions of all four examples; we have tried to select those examples that best illustrate the range of capabilities of individual systems. We have also reproduced examples of other repertoires and material related to special capabilities or personalities of individual systems. Other developers preferred to submit examples of their own choosing. All examples have been reduced 20% from the versions we received, unless otherwise indicated. Material that was still too wide to be shown horizontally has been rotated 90 degrees in preference to reducing it further. The order is random.

Comparisons can be deceptive, since no two products used exactly the same hardware. Stephen Dydo graciously provided printouts of the Bach chorale from both a dot matrix and a laser printer to illustrate how spacing control is affected by hardware capabilities and restraints (both versions were produced from the same data, the same program, and the same music font). The Byrd/Stickney examples illustrate the more subtle differences between a typesetter (Linotronics) and a laser printer (Apple), again using the same data,

the same program, and the commercially available Adobe 'Sonata' font. The printing devices used range in price from under \$500 to as much as \$50,000. Program prices range from under \$100 to nearly \$1,000. The range of prices for complete systems is from around \$10,000 to well above \$50,000.

Comparison of the output from similar printers driven by different programs ignores the important question of input methods, which was the main subject of the 1985 *Directory*. Alphanumeric code is the usual method for IBM PC and compatible computers, including the Hewlett Packard, Tandy, and Texas Instruments microcomputers represented in the illustrations. Apple Macintosh and Atari ST systems tend to use MIDI (electronic keyboard) data with graphic icons. The division between code-intensive and sound-and-graphics oriented systems is less distinct than it was a year ago in that some cross-over technology is beginning to appear: Apple and IBM products or features may be combined in systems designed especially for musical purposes.

Still at issue is the tradeoff between memory requirements and speed of processing. Systems of long standing tend to encode as much information as possible in as little space as possible. Dal Molin's Music Writer, written in assembly language to deal with a hexadecimal code generated by hardware specially designed for the purpose, uses less than 16K of memory. Programs of more recent vintage produce their own decisions on spacing, beaming, stem direction and so forth. This lengthens programs written in high level languages (some for the IBM PC exceed 256K) but reduces the bulk of the data. (As points of reference, one user submitted a single page of a Renaissance chanson that had consumed more than 32K of memory with a commercial music printing program, while DARMS users maintain that enough data to print a symphony can be encoded on one floppy disc. Since 1981, hard disc prices have dropped from \$100 per megabyte to \$10 per megabyte, and disc size has increased proportionally.) The underlying rationale of play-in systems is quite different: they capture pitch and duration data but may require extensive editing to produce a printed score.

Almost all software developers regard their current versions as incomplete. Some are still implementing such features as slurs, ornaments, and other performance-related refinements. Some are adapting mainframe or dedicated hardware systems to microcomputers. Many are seeking to broaden their hardware base to support a larger number of both microcomputers and printing devices. Some are working on user interfaces (programs to relieve users of the need to become computer experts in order to run programs). Some are adapting existing programs to make use of commercially available fonts, such as Adobe Systems' 'Sonata' font, while others are devising custom fonts. Some are developing libraries of special symbols to handle the markedly different needs of notationally unusual repertoires, such as music from the later Middle Ages and the later twentieth century. Some are building provisions into their systems to enable users to devise their own list of recallable symbols.

Cumulative List of Music Encoding and Printing Systems and Products

The following list of music printing and related encoding systems is in alphabetical order, with references to previous descriptions and illustrations. The quantity of information provided here is greater for systems that have not previously been listed but

should not be used as a gauge of merit. The systems marked with an asterisk accept work on a contractual basis.

Commercial products that either do not currently support printing of classical music or which have not made samples available for reproduction are not included in this listing, but the Center would like to acknowledge with gratitude the information about such systems that their developers from time to time submit.

ALMA. See **Plaine and Easie**.

ALPHA/TIMES. Commercially available system by Christoph Schnell of input, indexing, storage, and retrieval for Apple microcomputers. ALPHA is a database system originally designed for the Apple ///. TIMES-DB (previously called IRMA), an adaptation for the Macintosh, is a kernel of TIMES (Total Integrated Musicological Editing System), which combines a graphic editor, a text processor, a font editor, and a professional music editor for conventional notation. Input by voice recognition device generates DARMS code. Printing capability for standard, early and recent repertoires (in conjunction with Professional Composer, using Apple dot matrix and laser printers). Description, 1986. Illustrations, 1986, 1987 [#45].

AMADEUS MUSIC SOFTWARE.* Kurt Maas of Munich has made his originally proprietary music printing system commercially available. It is based on a DEC PDP-11 computer, accepts MIDI input, and supports dot matrix printers, plotters, and laser printers and phototypesetters. The programs require a UNIX (or IDRIS) operating system. The user must pay license fees in addition to the purchase price of the system. Amadeus prepares scores for publication by such enterprises as B. Schotts Söhne.

A-R Editions, Inc.* Proprietary system for music printing developed by Thomas Hall using a Data General mainframe, with a Versatec plotter for preliminary drafts and a Mergenthaler Linotron 202 typesetter for finished copy. The music is encoded in a DARMS dialect. Besides producing its own editions, which have been computer-generated for ten years, A-R sets musical examples for numerous journals including that of the American Musicological Society. Illustrations, 1987 [#13, #14].

CCARH. In-house system originally designed for the HP 1000 with an IBYCUS operating system (description 1985; illustrations 1985 and 1986). Experimental musical character cartridge for the HP LaserJet; downloadable characters for the LaserJet Plus and LaserJet II. Research on font design in progress.

CODEX. Printing program (Macintosh) for white mensural notation. Reported in 1986.

(The) Copyist. Software product for the Atari ST sold by Dr. T's. There is also an IBM PC version. This is a synthesizer-oriented product. Illustrations (dot matrix), 1987 [#27, #28]. Laser printing (HP LaserJet Plus), plotter output (HP-GL plotter); HP InkJet also supported. Epson printer compatibility.

Dal Molin. Armando Dal Molin has devoted a lifetime to the challenge of automating music printing. Inventor of the first musical typewriter, he has devised a series of systems that have generally been used under proprietary labels and in production-oriented

environments. His **Musicomp** terminal, a custom product with separate keypads for pitch (6 octaves) and other aspects of notation as well as text (128 redefinable characters), in conjunction with an Omnitech laser printer, has been producing roughly 1,000 pages of music a month for almost a decade. Belwin Mills Publishing Corp., a subsidiary of Columbia Pictures, is an active user of this technology. A photograph of the Musicomp terminal appears in *The New Grove Dictionary of Music and Musicians* (1980), 15, 258. It is described in "A Terminal for Music Manuscript Input," *Computers and the Humanities*, 12, 287-9. More recent developments and a description of his "pitch-character-space" code are given in a paper he presented in Zurich in October 1986 (copies available from the author). Illustrations, 1987.

Under the name **The Music Writer**, Dal Molin is currently adapting his system to run on an IBM PC and other 8088 or 80286 microcomputers. Currently, his program provides access to one music and one text font; he plans for two music and four text fonts in the completed product. This directory shows examples of a finished product from his main system [#15] and work in progress towards an adaptation for microcomputers [#37, #38].

DARMS. This is an encoding system, not a printing product (descriptions, 1985 and 1986), once known as the Ford-Columbia music representation language, after its original benefactor and university setting. First used on IBM mainframes, DARMS code has been used for dedicated printing purposes by Lincoln and Morehen (illustrations, 1986). Subsets of DARMS code have been used by many others for diverse purposes. DARMS manual (1976) available from Raymond Erickson; revision by McLean planned. Completion of microcomputer software for three-dimensional representation (DARMS 'cube') of formal ('canonical') DARMS by McLean intended for August 1987. DARMS code is used by Stephen Dydo in his printing program, **The Note Processor**.

Deluxe Music Construction Set. Software product for the Macintosh (alternative versions for other microcomputers) developed by Geoff Brown. Illustrations, 1986 (Apple LaserWriter and Linotronics typesetter) and 1987 (Linotronics typesetter; #39, #40).

ETH. The Eidgenössische Technische Hochschule [Swiss Federal Institute of Technology] has under development at its Institut für Informatik in Zurich a research prototype for an interactive editor of complex musical notation. This effort involves the use of an abstract representation of certain features of musical notation. The system is implemented in Modula-2 and runs on a LILITH workstation. Giovanni Müller is the principal investigator. Illustration, 1987 [#44].

FASTCODE. An encoding language (middle and late '70's) derived from the still earlier IML-MIR (early 1970's); both versions originated at Princeton University. Printing capability for white mensural notation partially developed by Thomas Hall. A modified version of the code is currently used by Leeman Perkins (Columbia University) for the Busnois edition. The proprietary system used by A-R Editions* is indebted in a general way, through the work of Thomas Hall, to this system. Descriptions, 1985 and 1986; illustration, 1985.

Grawemeyer Industries.* Current users of the system previously developed by MusiGraph.

GUIDO. A music learning system oriented toward classroom use for music theory, ear training, and music appreciation. There are Macintosh and IBM PC versions, although the development work was done on the PLATO system. A series of video discs is now available. No music printing capability has been reported. Description, 1986.

Graphic Notes. Commercial software from Australia for Macintosh-based music printing. Release expected in the last quarter of 1987. The developer is Trevor Richards.

Gregory's Scribe. Printing program for Gregorian chant for the Apple //; hardware component no longer in manufacture. Description, 1985; also in the *Computer Music Journal* VII/1 (1983).

H-Score. Software from Hybrid Arts for the IBM PC. Synthesizer-oriented. User-created examples submitted but not reproduced.

High Score. Music printing software for the Macintosh, using the PostScript 'Sonata' font. Still under development. Described, 1986 Supplement, and in the popular press as a joint venture by Kimball Stickney and Don Byrd doing business as Advanced Music Notation Systems. Illustrations, 1987 [#41, #42].

The partnership is now dissolved. Stickney retains the product name; his version will be released by Southworth Music Systems. Byrd retains the company name and is working on a user interface for his product, which will be called **Nightingale** and is designed to work in a number of graphics environments. The program is a derivative of SMUT (see **MUSTRAN**).

IML-MIR. Linked encoding (Intermediary Musical Language) and query (Music Information Retrieved) languages developed at Princeton. See **FASTCODE**.

IMS (Interactive Music System). A PLATO-based system developed over many years at the University of Illinois. Broad capabilities for transcription, screen editing, playback, and printing. Input by alphanumeric code or from synthesizer. Adaptations of the printing system for use with NEC, IBM, and Macintosh microcomputers, the Toshiba P1350 dot matrix printer, and the HP LaserJet series are currently in progress. An associated program, LIME, is a graphic screen editor. OPAL is a language for music description and algorithmic manipulation of scores. Stand-alone version for the Apple Macintosh with a large screen and a MIDI keyboard under development. Descriptions 1985 and 1986; illustrations 1985, 1986, 1987 [#46]. Revised manual (January 1987) by Lippold Haken and Valerie Schmid; article by Carla Scaletti in the *Computer Music Journal* 9/1 (1985). [For other work at Illinois, see also **NEWNOTE** and **OLDNOTE**.]

IRMA (Information Retrieval for Multiple Musicological Applications). See **ALPHA/TIMES**.

Laffangraff. See **The Music Editor**.

Lasergraphics. Proprietary system. See **Dal Molin**.

LIME. See **IMS**.

McLeyvier. David McLey's McLeyvier system was oriented towards the needs of composers. Its sophisticated graphics were said to be comparable with those of the Mockingbird system. The system is now the property of Syntronics in Toronto and is not in active use for music typography.

MEG (Music Editing and Graphics). Developed in Rome, originally for the Apple //, later adapted to the IBM PC. Some scores published by Universal Edition in Vienna. Description, illustration 1986. See *ICMC Proceedings 1984*.

Mockingbird. An interactive editor and printing system for musical notation (primarily keyboard music) developed in 1980 at the Palo Alto Research Center (supported by the Xerox Corp). Experimental in nature, the programs (in Mesa) ran on the Xerox 1132 computer and accepted keyboard input. No commercial versions have been made available. Description, 1985.

music. A music preprocessor for the troff typesetting system; operates in a UNIX environment. Under development at Nottingham University (U.K.) by Eric Foxley. Custom language for description of musical scores; custom music fonts work with Chelgraph laser printer. Documentation from the author. Listed, 1986.

(The) Music Editor. Music printing program by John Laffan for the IBM PC. Description, 1985; illustrations, 1985 and 1986.

(The) Music Factory*. Service using software for the IBM PC by Stephen Dydo. (See description for **The Note Processor**.) Listed, 1986. Forthcoming publications with musical examples from The Music Factory include two Schirmer books, Kerala Snyder's *Buxtehude: Organist at Lübeck* and Glenn Watkins' *Soundings: Music in the Twentieth Century*.

(The) Music Processor. Program by Etienne Darbellay for the Texas Instruments Professional and Business Pro computers. Handles numerous special notations (ligatures, black and white mensural notation), piano reductions, and three sizes of symbols; permits user-defined graphics. Conversion for the IBM PC underway. Descriptions, 1985, 1986; illustrations, 1985, 1986, 1987 [#21-#23].

(The) Music Writer. IBM PC version of Dal Molin's system for entering and printing music. See Dal Molin.

MUSICA. A language for musical encoding used at the University of Padua. Alphanumeric system completed in 1981. Described in *Interface* 11/1, 1-27.

MUSICODE and MUSICODE/A. Fred T. Hofstetter developed MUSICODE as part of his M.A. thesis at Ohio State University in 1970. It is an alphanumeric encoding system. A revised version by Ann Blombach is called MUSICODE/A.

Musicomp Terminal. See Dal Molin.

Musicprinter. Program by Jack Jarrett for printing music with the Apple //+. Illustration, 1986.

Musicsys 3600. A proprietary system for editing and sound with a music printing capability. Based on the Symbolics 3600, a LISP-based machine; designed by Bernard S. Greenberg. Description, illustration, 1985.

MusiGraph. A proprietary system for music printing originally developed by William Watkins. The system is now owned by Grawemeyer Industries* in Lexington, KY. The original MusiGraph system generated notational descriptions from a Tandy TRS-80 microcomputer and printed them on a typesetter; beams and slurs were added by hand. The system provides musical examples for the *Journal of Musicology* and scores for a number of music publishers including C. F. Peters (New York).

MusPrint. Music printing program by Keith Hamel for the Macintosh. Illustration, 1986.

MusScript. Successor to MusPrint. It uses the Postscript 'Sonata' font. Illustration, 1987 [#32].

MUSTRAN. An encoding language originated by Jerome Wenker at Indiana University in the 1960's. Original focus on ethnomusicology. Used as a basis for the development of analytical and instructional capabilities, especially by Dorothy Gross and Gary Wittlich, and for music printing by Donald Byrd. MUSTRAN programs have been run on the IBM PC. SMUT, a plotter notation program in FORTRAN by Byrd, ran on some Indiana University mainframes. No MUSTRAN-based printing capability for microcomputers has been reported.

Byrd's current commercial interest is in developing sophisticated music editing capabilities for Macintosh computers and for Sun and Apollo workstations. He is also taking a position at Princeton University in the autumn of 1987 that entails developing a music printing capability for twentieth-century music using the 'C' language in a UNIX environment.

NEWNOTE and OLDNOTE. Programs developed by L. Rumery at the University of Illinois in c. 1980 to encode and print sixteenth-century vocal music in both modern and mensural notation. Designed for the PLATO system (see also IMS).

Nightingale. Macintosh-based program for music printing, under development by Donald Byrd. See *High Score*, MUSTRAN.

(The) Note Processor. IBM PC-based program for printing music by Stephen Dydo. Input by DARMS code or mouse. The program runs on IBM PC and compatible microcomputers and supports Toshiba, Epson, and NEC dot matrix printers as well as the HP LaserJet II. Illustrations, 1986, 1987 [#24-#26]. See also *The Music Factory*.

Notepro. A system of encoding used at the University of Illinois by James Beauchamp and others. Synthesis-oriented. Reference manual.

Noteprocessor. Music printing program for the Apple //. Developed by Piero de Berardinis, one of the first to devise a way of playing music directly into a microcomputer (1983); also the founder of the Italian review *Informatica musicale* (1982--). Illustration, 1987 [#30].

Oberon Systems. Oberon's System I* was developed in 1981 and is based on the Hewlett Packard 1000 microcomputer. Oberon offers a fully tested package of current hardware and software tools (for approximately \$10,000) that more or less duplicates its own capabilities. It also offers typesetting services and data storage backup. Its System II music font for the HP Vectra and other IBM PC compatibles can be used with any screen editor that allows keying of characters in the font and control characters in the text. Musical files can be excerpted and merged with text files (created with such programs as Memomaker, Wordperfect, and MS Word). Oberon professes a commitment to keeping upgrades compatible with existing products. It is currently engaged in efforts to improve its software for choral music. Illustrations, 1987 [#35, #36].

OLDNOTE. See NEWNOTE.

OPAL. See IMS.

ORPHEUS. See IMS.

Oxford Music Processor. IBM PC-based program for printing music announced by Oxford University Press; not yet released. Input involves redefinition of the keyboard. Supports both dot matrix and plotter output. Derived from a mainframe program by Richard Vendome,* the original version of the OMP has been in active use for setting recent performing editions by OUP and musical examples for Oxford journals such as *Early Music* and *Music and Letters*. Description, 1986; illustrations, 1986, 1987 [#43].

Personal Composer. IBM PC-based music printing program by Jim Miller. Synthesizer-based. PostScript 'Sonata' font for the Apple LaserWriter. Illustrations, 1986, 1987 [#29].

Plaine and Easie. Plaine and Easie is a melodic input code developed by Barry Brook and Murray Gould in the late 1960's. It has been especially widely used for thematic indexing and has also been central to the manuscript cataloguing efforts of RISM Series A projects. ALMA, an extension by Gould, accepts chordal notation. Programs for plotter output of musical notation were developed in the 1970's by Norbert Böker-Heil. Description, 1985, 1986. Illustration, 1986.

Professional Composer. Screen editing and printing program for the Macintosh. Synthesizer-based. Currently in use for the preparation of musical editions by Garland Press. Illustrations, 1986, 1987 [#31].

SCAN-NOTE System. This proprietary system for printing music was designed by Mogens Kjaer and developed in the late 1970's by Dataland ApS in Aarhus, Denmark. It was subsequently sold to the Japanese firm Toppan and has undergone further development. See Toppan.

SCORE. Music printing program for the IBM PC and compatibles derived from SCORE/MS. SCORE was scheduled for release by Passport Designs in June 1987. Several sublibraries of symbols for special repertoires and accommodation of user-defined symbols are provided. An Apple LaserWriter is currently supported and versions compatible with other printers are currently under development. Illustrations, 1987 [#18-#20].

SCORE/MS. A music printing system developed (in FORTRAN) at Stanford University for the PDP-10 computer and a Versatec plotter in the early '70's by Leland Smith. Many special capabilities for early and recent music as well as standard repertoires. Descriptions and illustrations, 1985, 1986.

SCRIBE. A system for transcribing, editing, and analysis of early music (through the Renaissance) under development on a DEC VAX at La Trobe University in Australia. Facsimiles in neume or pitch notation use a Houston plotter. Description, 1986.

Synclavier. A music printing option for the well-known synthesizer called a Synclavier has been offered by New England Digital Corporation since 1982. Three versions have appeared; the third of these, supporting laser printing, has been available for a year. To print music a user needs a Synclavier system, a graphics terminal, proprietary software, and one of seven printers that the system supports. These include a 300-dots-per-inch Dataproducts printer, the Apple LaserWriter, and the Linotronics 100 and 300 (2540 dots per inch). Illustration, 1987 [#16].

The Synclavier music printing option is used by a number of professional music copying services, including that of Ted Petrosky [#17], whose Symphony Reproductions, Inc., is "engraving" the complete works of Gordon Getty.

TAUMUS. Original name of TELETAU.

TELETAU. An integrated system combining a repository of musical data and software for management, analysis, and telecommunications. Initially developed at CNUCE in Pisa and now maintained jointly with the Florence Conservatory. Active research program. No musical printing at present. Library of 800 encoded pieces. Manual available from Pietro Grossi (CNUCE) and Lelio Camilleri (CNUCE; Florence Conservatory). Description, 1986. Electronic addresses: *MUSIC3@ICNUCEVM* and *CHERU@IFIIDG* [both *BITNET*].

THEME: The Music Editor. IBM PC-based software by Mark Lambert for music printing. Input involves redefinition of QWERTY (standard typewriter) keyboard. Permits mensural notation. Version 3.0 for Epson-compatible dot matrix printers supports incorporation of musical examples in text using PC-Write. Illustrations, 1987 [#33, #34].

TIMES. See **ALPHA/TIMES**.

Toppan Scan-Note System.* A highly evolved system for quality music "engraving" serving the Japanese and European markets since 1983. It uses the **Scan-Note** system originally developed in Denmark. In its current configuration, the system uses a CRT terminal for entering layout information and lyrics, a piano keyboard for entering pitch, and a laser phototypesetter. Toppan Printing Co., Ltd., contracts with major music publishers, such as Bärenreiter Verlag, for whom it prepared a recent volume of the *Neue Mozart Ausgabe* -- the *Divertimenti und Serenaden für Blasinstrumente* (Ser. VII, N. 17). Illustrations, 1987 [#8-#12].

troff. See **music**.

Waseda University. See **Log: Facilities - Toyko**.

Proprietary Systems -- 1a Toppan Scan-Note System

Software: custom, in 'C'

Unreduced

[illegible]

Illustration 9
Proprietary Systems -- 1b
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard

Software: custom, in 'C'

Printing device: unidentified laser phototypesetter

Unreduced

Preludio

Moderato (♩ = 60)

The musical score is written for piano in common time (C). It begins with a tempo marking of **Moderato** and a quarter note equal to 60 beats per minute (♩ = 60). The piece is in C major, indicated by the key signature. The score is divided into two systems. The first system consists of two staves. The right staff has a whole rest followed by a quarter rest, then a group of four beamed sixteenth notes (G4, A4, B4, C5) with a fingering of 4. The left staff begins with a forte (*f*) dynamic and a series of beamed sixteenth notes, with fingerings 2, 2, 1, 3, 1, 3, 1, 3, 4, and 4. The second system also consists of two staves. The right staff begins with a mezzo-forte (*mf*) dynamic and a series of beamed sixteenth notes, with fingerings 2, 4, 2, 3, and 3. It then moves to a fortissimo (*sf*) dynamic with a series of beamed sixteenth notes, with fingerings 1, 4, 3, 1, 5, and 1. The left staff begins with a mezzo-forte (*mf*) dynamic and a series of beamed sixteenth notes, with fingerings 4, 2, 3, and 5. It then moves to a fortissimo (*sf*) dynamic with a series of beamed sixteenth notes, with fingerings 5, 5, 1, 2, 3, and 5. The piece concludes with a fortissimo (*sf*) dynamic and a series of beamed sixteenth notes, with fingerings 5, 5, 1, 2, 3, and 5.

Illustration 10

Proprietary Systems -- 1c Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard

Software: custom, in 'C'

Printing device: unidentified laser phototypesetter

Unreduced

The image displays a musical score for a piano and voice, titled "Proprietary Systems -- 1c Toppan Scan-Note System". The score is presented in two systems of staves. Each system includes a grand staff (treble and bass clefs) and a single vocal line. The music is written in common time (C) and features complex, rapid passages with many beamed notes and slurs. The vocal line includes a "dolce" marking. The score is printed on a laser phototypesetter, showing high contrast and sharp lines. The overall layout is clean and professional, typical of a high-quality musical score print.

Illustration 11
Proprietary Systems -- 1d
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard

Software: custom, in 'C'

Printing device: unidentified laser phototypesetter

Unreduced

Presto $\text{♩} = 66$

Flauto I
 Flauto II
 Oboe I
 Oboe II
 Clarinetto I in B
 Clarinetto II in B
 Fagotto I
 Fagotto II
 Contrafagotto

ff

Corni in D
 Corni in B
 Trombe in D

ff

Timpani in D.A.

ff

Presto $\text{♩} = 66$

Violino I
 Violino II
 Viola
 Violoncello
 Basso

f

Illustration 12

Proprietary Systems -- 1e
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard

Software: custom, in 'C'

Printing device: unidentified laser phototypesetter

Unreduced

The musical score is presented in six systems, each consisting of a treble and bass staff. The key signature is one sharp (F#), and the time signature is 4/4. The score includes various musical notations such as triplets, slurs, and dynamic markings (f, ff). Fingerings are indicated by numbers 1-3. The piece features several octave shifts, marked as '8va bassa'. The notation is dense and complex, typical of a technical or experimental musical work.

Illustration 13
 Proprietary Systems -- 2a
 A-R Editions, Inc. (Thomas Hall)

Computer: Data General mainframe
 Printing device: Mergenthaler (Linotron) 202 typesetter

Magnificat "Regale"



[Superius] II

[Medius]

[Contratenor]

[Tenor]

[Bassus]

Et ex- sul-

Et ex- sul-

Et ex- sul-

Et ex- sul-

Et ex- sul-

sul- ta-

ta- vit spi-

ta-

ta-

ta-

*Plainsong on Tone VIII for the odd-numbered verses has been supplied from the Sarum Tonal in *The Use of Sarum*, ed. Walter H. Frere (1901), Appendix, ii.

Proprietary Systems -- 2b
A-R Editions, Inc. (Thomas Hall)

Printing device: Mergenthaler (Linotron) 202 typesetter

FINAL
Allegro agitato

Flutes I II
Oboes I II
Clarinet I II
Bassoons I II
Horns in G I II
Timpani (G, D)
Violin I
Violin II
Viola
Cello, Double-bass

p
pp
dolce

10

Illustration 15
Proprietary Systems -- 3
Lasergraphics (Armando Dal Molin)

Input device: PCS-500 Musicomp terminal

Printing device: Omnitech laser printer

[This system is currently in use by Belwin Mills, a subsidiary of Columbia Pictures]

551 A Mighty Fortress Is Our God

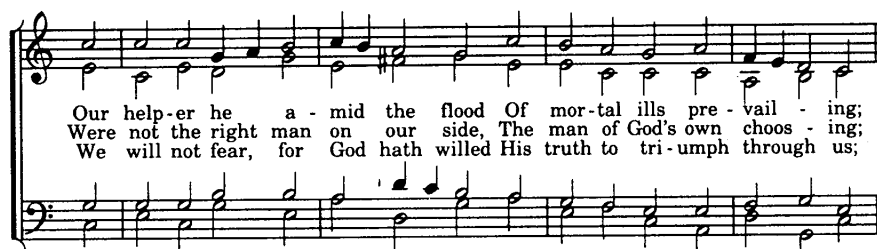
87.87.66.667

EIN' FESTE BURG

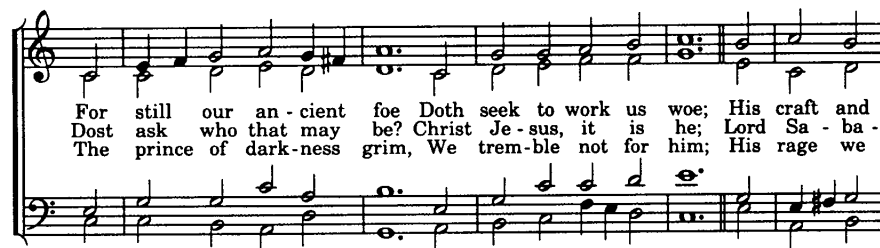
Melody, MARTIN LUTHER, 1529



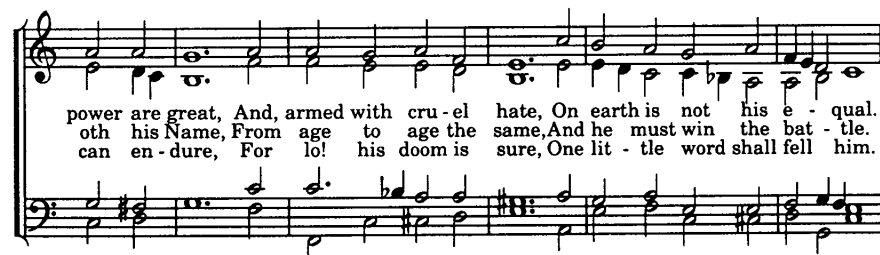
A might-y for - tress is our God, A bul-wark nev - er fail - ing;
 Did we in our own strength con-fide, Our striv-ing would be los - ing;
 And tho' this world, with dev - ils filled, Should threat-en to un - do us;



Our help-er he a - mid the flood Of mor-tal ills pre - vail - ing;
 Were not the right man on our side, The man of God's own choos - ing;
 We will not fear, for God hath willed His truth to tri-umph through us;



For still our an - cient foe Doth seek to work us woe; His craft and
 Dost ask who that may be? Christ Je - sus, it is he; Lord Sa - ba -
 The prince of dark-ness grim, We trem-ble not for him; His rage we



power are great, And, armed with cru-el hate, On earth is not his e - qual.
 oth his Name, From age to age the same, And he must win the bat - tle.
 can en - dure, For lo! his doom is sure, One lit - tle word shall fell him.

dal molin - lasergraphics (1984)

Synclavier Music Engraving System

Font: custom; original resolution = 2540 dots per inch

FRANZ LISZT

The image displays a musical score for the song "L'Espresso" by Francesco De Gregori. The score is written for piano and voice, with the piano part in the upper staves and the voice part in the lower staves. The key signature is one sharp (F#), and the time signature is 3/4. The score is divided into several systems, each containing a piano part and a voice part. The piano part includes various musical notations such as notes, rests, and dynamic markings (p, mf, cresc., poco a poco rallent., p smorzando, f, leggiero, sva, loco, ff, dolce). The voice part includes lyrics in Italian, such as "grazioso", "sopra", "poco a poco rallent.", "p smorzando", "lento", "pp", "a tempo", "f", "leggiero", "sva", "loco", "dolce", and "ff". The score is presented in a clear, professional layout, with the piano part in the upper staves and the voice part in the lower staves. The lyrics are written in Italian, and the music is in a 3/4 time signature. The score is divided into several systems, each containing a piano part and a voice part. The piano part includes various musical notations such as notes, rests, and dynamic markings (p, mf, cresc., poco a poco rallent., p smorzando, f, leggiero, sva, loco, ff, dolce). The voice part includes lyrics in Italian, such as "grazioso", "sopra", "poco a poco rallent.", "p smorzando", "lento", "pp", "a tempo", "f", "leggiero", "sva", "loco", "dolce", and "ff".

Commercial Systems -- 1b

Synclavier Music Engraving System

Choral

Choral

Soprano. Alto. Tenore. Basso. Continuo.

Ob sich's au - liess, als wollt, er nicht lass dich es nicht er - schre - cken;
Denn wo er ist am be - sten mit, da will er's nicht ent - de - cken

Ob sich's au - liess, als wollt, er nicht lass dich es nicht er - schre - cken;
Denn wo er ist am be - sten mit, da will er's nicht ent - de - cken

Ob sich's au - liess, als wollt, er nicht lass dich es nicht er - schre - cken;
Denn wo er ist am be - sten mit, da will er's nicht ent - de - cken

Ob sich's au - liess, als wollt, er nicht lass dich es nicht er - schre - cken;
Denn wo er ist am be - sten mit, da will er's nicht ent - de - cken

Ob sich's au - liess, als wollt, er nicht lass dich es nicht er - schre - cken;
Denn wo er ist am be - sten mit, da will er's nicht ent - de - cken

Illustration 18

Software for Printing Music -- 1a SCORE (Leland Smith)

Computer: Tandy 2000 (IBM PC compatible)

Printing device: Apple LaserWriter

Software vendor: Passport Designs

Part extraction from score (or score assembly from parts) showing size differentiation

The image displays three staves of musical notation, each featuring a key signature of one sharp (F#) and a time signature of 3/4. The notation is divided into two measures by a vertical bar line. The first measure of each staff is marked with a forte 'f' dynamic. The second measure is marked with a mezzo-forte 'mf' dynamic. The notation includes various note values, rests, and accidentals, demonstrating the software's ability to handle complex musical structures and dynamic markings.

Illustration 19 **Software for Printing Music -- 1b** **SCORE (Leland Smith)**

Computer: Tandy 2000 (IBM PC compatible)
Printing device: Apple LaserWriter
Software vendor: Passport Designs

Parameters for control of spacing

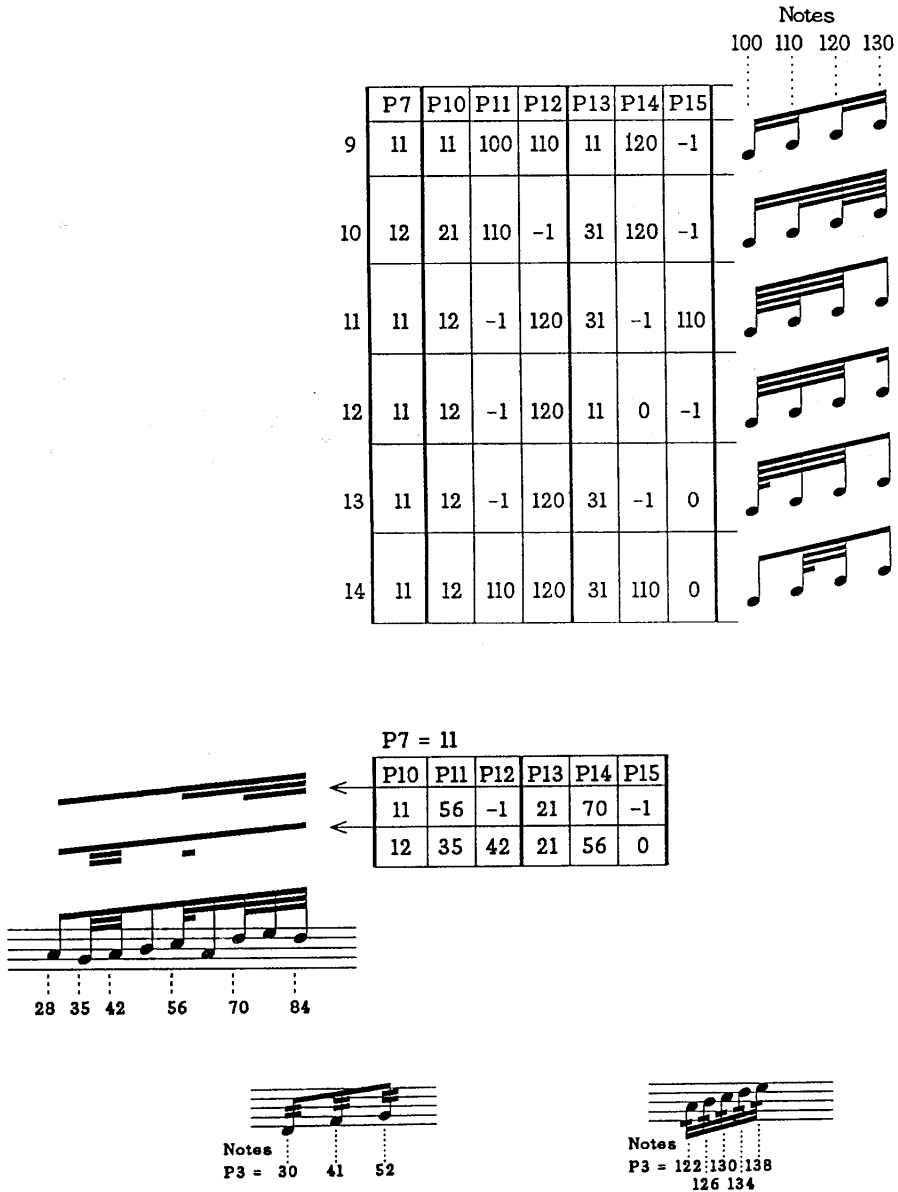
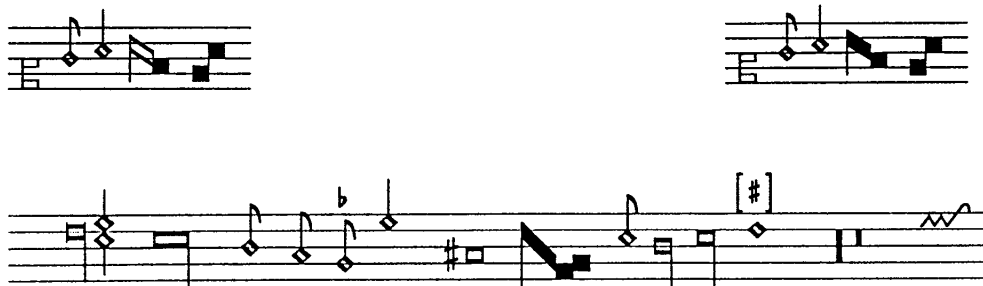


Illustration 20
Software for Printing Music -- 1c
SCORE (Leland Smith)

Computer: Tandy 2000 (IBM PC compatible)
Printing device: Apple LaserWriter
Software vendor: Passport Designs

Special libraries for early music notation, guitar tablature, percussion



P5 = -1
P13 = 1 P13 = 11 P13 = 123 P13 = 123000 P13 = 541111 P13 = 339222 P6 = .8



Illustration 21

Software for Printing Music -- 2a Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15

dolce

CHORAL.

Ob sich's anliess, als wollt'er nicht, lass dich es nicht erschre_cken,
Denn wo er ist am be_sten mit, da will er's nicht ent_de_cken;

Ob sich's anliess, als wollt'er nicht, lass dich es nicht erschre_cken,
Denn wo er ist am be_sten mit, da will er's nicht ent_de_cken;

Ob sich's anliess, als wollt'er nicht, lass dich es nicht erschre_cken,
Denn wo er ist am be_sten mit, da will er's nicht ent_de_cken;

Ob sich's anliess, als wollt'er nicht, lass dich es nicht erschre_cken,
Denn wo er ist am be_sten mit, da will er's nicht ent_de_cken;

4 2 5 5 6 6 4 9 8 6 4 5 6 5 5 6 8 7 1

Illustration 22
Software for Printing Music -- 2b
Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15

Creation of two-stave reduction from five-part score

GESUALDO, 6th Book (1613)

Io pur re- spi-ro, io pur respi- ro
Io pur re- spi-ro, re- spiro
Io pur re- spi-ro, re- spiro
Io pur re- spi-ro re-spi- ro in co-si
Io pur re- spi- ro
Io pur re- spi- ro

Illustration 23

Software for Printing Music -- 2c Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15

Early music, editing, and drawing capabilities



Sample for some possibilities in complex contexts (chords and beaming)

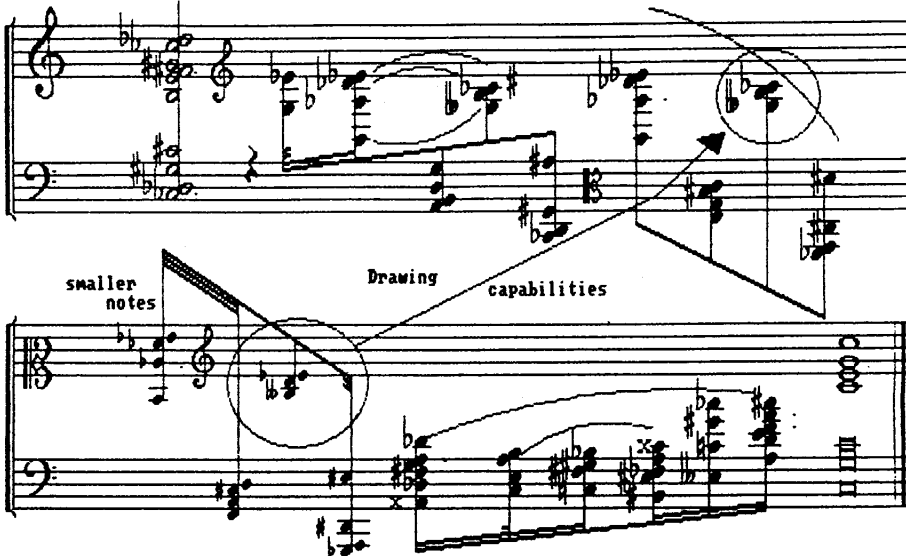


Illustration 24

Software for Printing Music -- 3a The Note Processor (Stephen Dydo)

Computer: IBM PC

Printing device: NEC P6 dot matrix printer (180 dots per inch)

Font: custom

Music by Stephen Dydo

Adagio

Musical score for Adagio, measures 1-4. The score is in 3/4 time and features a treble and bass staff. The key signature has one sharp (F#). The melody in the treble staff consists of eighth and quarter notes. The bass staff features triplet eighth notes in measures 1-3 and a 5:3 ratio in measures 3-4. The tempo marking 'Adagio' is above the first staff.

Computer: IBM PC

Printing device: NEC P6 dot matrix printer (180 dots per inch)

Font: custom

Musical score, measures 4-10. The score continues from the previous page, measures 4-10. It features a treble and bass staff. The key signature has one sharp (F#). The melody in the treble staff consists of eighth and quarter notes. The bass staff features eighth and quarter notes. The score includes dynamic markings: *f* (forte), *p* (piano), and *pp* (pianissimo). The tempo marking 'Adagio' is above the first staff.

Illustration 25

Software for Printing Music -- 3b The Note Processor (Stephen Dydo)

Computer: IBM PC
Printing device: NEC P6
Font: custom

1 CHORAL

Soprano

Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Alto

Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Tenore

Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Basso

Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Continuo

5 6 5 6 6 5 6 6 5 6 5 6 5 2

Illustration 26

Software for Printing Music -- 3c The Note Processor (Stephen Dydo)

Computer: Hewlett Packard Vectra (IBM PC compatible)

Printing device: HP LaserJet II (300 dots per inch)

Music font: custom

Text font: HP 8 pt. Times Roman Softfont

Unreduced

CHORAL

The musical score is for a choral piece. It features five staves: Soprano, Alto, Tenore, Basso, and Continuo. The key signature is D major (two sharps) and the time signature is common time (C). The lyrics are printed below the vocal staves. The Continuo staff includes figured bass notation below the notes.

Soprano
Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Alto
Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Tenore
Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Basso
Ob sich's an- liess, als wollt' er nicht, lass
Denn wo er ist am be - sten mit, da

Continuo
5 6 5 6 6 9 8 6 5 6 5
4 5 5 5 5 9 8 6 5 6 5
2

Software for Printing Music -- 4a

The Copyist (Cris Sion)

Computer: Atari ST (with sequencer software)
[alternative version for IBM PC with sequencer software]
Printing device: Panasonic KX-P1091 (Epson compatible)
[HP Inkjet, GL plotter, and Laserjet Plus also supported]
Vendor: Dr. T's Music Software

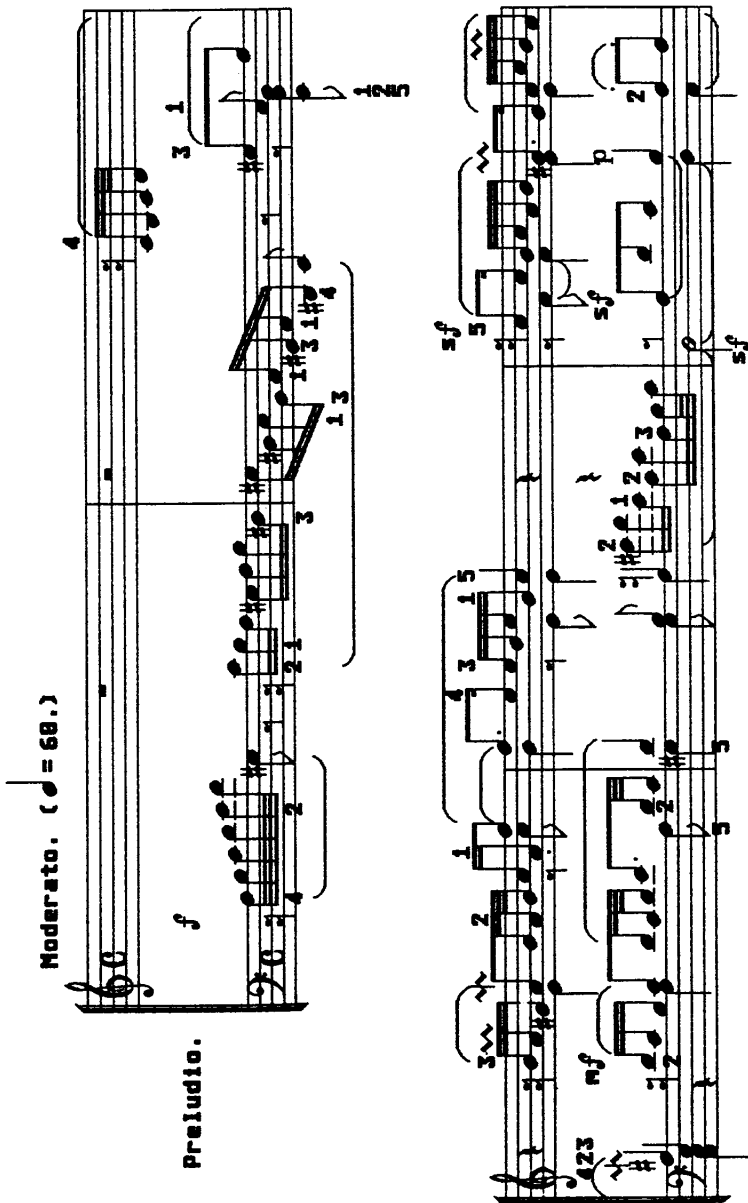


Illustration 28

Software for Printing Music -- 4b The Copyist (Cris Sion)

Computer: Atari ST (with sequencer software)
[alternative version for IBM PC with sequencer software]
Printing device: Panasonic KX-P1091 (Epson compatible)
[HP Inkjet, GL plotter, and Laserjet Plus also supported]
Vendor: Dr. T's Music Software

Soprano.
Flauto traverso in 8a.
Oboe d'amore, Violino I
col Soprano.

Alto.
Violino II coll'Alto.

Tenore.
Viola col Tenore.

Basso.

Continuo.

Ob schicks an_Iess, als witter nicht, lass dich es nicht erschre_cken,
Denn wo er ist an be_sten mit, da wille's nicht ent_de_cken;

Ob schicks an_Iess, als witter nicht, lass dich es nicht erschre_cken,
Denn wo er ist an be_sten mit, da wille's nicht ent_de_cken;

Ob schicks an_Iess, als witter nicht, lass dich es nicht erschre_cken,
Denn wo er ist an be_sten mit, da wille's nicht ent_de_cken;

Ob schicks an_Iess, als witter nicht, lass dich es nicht erschre_cken,
Denn wo er ist an be_sten mit, da wille's nicht ent_de_cken;

Ob schicks an_Iess, als witter nicht, lass dich es nicht erschre_cken,
Denn wo er ist an be_sten mit, da wille's nicht ent_de_cken;

5 6 5 6 3 5 8 6 5 6 5 5 4 2 5 6 6 7

Illustration 29

Software for Printing Music -- 5 Personal Composer System II (Jim Miller)

Computer: IBM PC compatibles
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

Personal Composer, PO Box 648, Honaunau, HI 96726

String Quartet in C# Minor, Opus 131

Ludwig van Beethoven
(1826)

Adagio ma non troppo e molto espressivo.

The musical score is for a String Quartet in C# Minor, Opus 131 by Ludwig van Beethoven. The tempo and expression marking is "Adagio ma non troppo e molto espressivo." The score is written for four parts: Violino I, Violino II, Viola, and Violoncello. The key signature is C# minor (three sharps: F#, C#, G#). The time signature is 3/4. The score consists of four systems of music. The first system shows the beginning of the piece with a "cresc." marking in Violino I and "f" and "p" markings in Violino II. The second system continues the music with "cresc." and "dim." markings in Violino I and "cresc." and "f" markings in Violino II. The third system shows further development with "cresc." and "f" markings in Violino I and "cresc." and "p" markings in Violino II. The fourth system concludes the piece with "p" and "cresc." markings in Violino I and "p" and "cresc." markings in Violino II. The Viola and Violoncello parts are mostly silent in the first system, with the Viola entering in the second system and the Violoncello entering in the third system.

Violino I.

Violino II.

Viola.

Violoncello.

Illustration 30

Software for Printing Music -- 6 Noteprocessor (Piero De Berardinis)

Computer: Apple II

Printing device: C.ITOH 8510A with Apple interface #85APL-II

Coro I.II. Johann Sebastian Bach

Soprano
in ripieno

Flauto
traverso I

Flauto
traverso II

Violino II.

Flauto III.

Flauto IV.

Oboe I.

Oboe II.

Violino I.

Organo
e continuo.

Viola.

(C) 1985 by SEV

Illustration 31
Software for Printing Music -- 7
Professional Composer

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Vendor: Mark of the Unicorn

GLUCK ZU KREUZ 8.7.8.7.
HARMONIZED BY CHARLES WOOD

FLOSSIE L. HEYWOOD
Darmstadt Gesangbuch, 1698

1. Armed with faith, may we press on - ward
2. Like the star of Beth - le - hem shin - ing
3. Hear our pray er, O gra - cious Fa - ther,

The first system of the musical score is written on two staves (treble and bass clef) in 3/4 time. It contains three verses of lyrics. The melody is simple and homophonic, with the bass line providing a steady accompaniment. The lyrics are printed below the notes, with hyphens indicating syllables that span across measures.

Know - ing noth - ing but.. Thy will; Con - que - ring
Love will guide us all.. the way From the
Au - thor of... ce les - tial good, That Thy

The second system of the musical score continues the melody from the first system. It also consists of two staves and three verses of lyrics. The musical notation includes various note values and rests, with the lyrics aligned to the notes. The overall style is that of a traditional hymn tune.

Illustration 32
Software for Printing Music -- 8
MusScript (Keith Hamel)

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

Moderato ♩.60

Preludio

The musical score is titled 'Preludio' and is in C major, Moderato, 60 beats per minute. It is written for piano. The first system shows a treble clef staff with a whole rest and a bass clef staff with a forte (f) dynamic. The second system shows a treble clef staff with a mezzo-forte (mf) dynamic and a bass clef staff with a mezzo-forte (mf) dynamic. The score includes various dynamics (f, mf, sf, p) and includes fingerings (1-5) and articulation marks (accents, slurs).

Illustration 33

Software for Printing Music -- 9a
Theme: The Music Editor (Mark Lambert)

Computer: IBM PC-compatible Zenith Z-158

Printing device: Star Micronics Gemini 10X dot-matrix printer

CHORAL

Soprano.

Alto.

Tenore.

Basso.

Continuo.

5 6 6 8 7
4

Illustration 34

Software for Printing Music -- 9b

Theme: The Music Editor (Mark Lambert)

Computer: IBM PC-compatible Zenith Z-158

Printing device: Star Micronics Gemini 10X dot-matrix printer

Moderato



Illustration 35

Software for Printing Music -- 10a
Oberon System II (Nancy Colton)

Computer: Hewlett Packard Vectra (IBM PC compatible)
Printing device: HP LaserJet Plus
Font: Oberon Music Font



Software for Printing Music -- 10b
Oberon System II (Nancy Colton)

Computer: Hewlett Packard Vectra (IBM PC compatible)
Printing device: HP LaserJet Plus
Music font: Oberon Music Font
Text: Word Perfect

I. Choral

Soprano.
Flauto traverso in 8a.
Oboe d'amore, Violino I.
col Soprano.

Alto.
Violino II coll' Alto.

Tenore.
Viola coll Tenore.

Basso.

Continuo.

Illustration 37

Software for Printing Music -- 11a Music Writer (Armando Dal Molin)

Computer: IBM PC with custom 'piano keyboard' peripheral
Printing device: Okidata 192 dot matrix printer
[Epson and IBM dot matrix printers also supported]

CHORAL.

The musical score is for a choral piece. It features five vocal parts: Soprano, Alto, Tenore, Basso, and Continuo. The lyrics are in German and are repeated for each part. The Continuo part includes figured bass notation.

Soprano
Ob sich's an - liess, als wollt' er nicht, lass
Denn wo er ist, am be - sten mit, da

Alto
Ob sich's an - liess, als wollt' er nicht, lass
Denn wo er ist, am be - sten mit, da

Tenore
Ob sich's an - liess, als wollt' er nicht, lass
Denn wo er ist, am be - sten mit, da

Basso
Ob sich's an - liess, als wollt' er nicht, lass
Denn wo er ist, am be - sten mit, da

Continuo
5 6 3 6 6 9 8 6 5 6 5
4 5 3 3#
2

Illustration 38

Software for Printing Music -- 11b Music Writer (Armando Dal Molin)

Computer: IBM PC with custom 'piano keyboard' peripheral

Printing device: Okidata 192 dot matrix printer

[Epson and IBM dot matrix printers also supported]

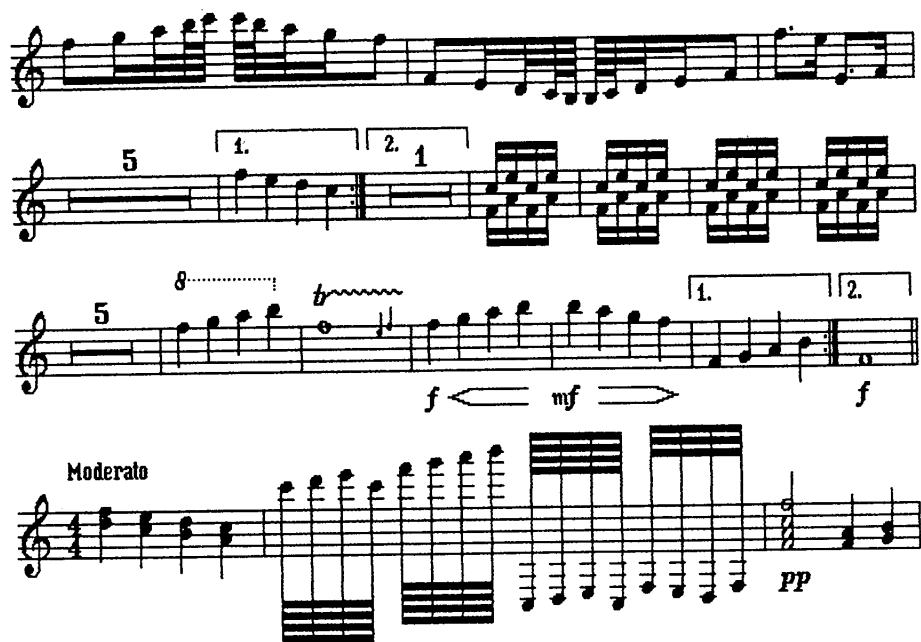


Illustration 39

Software for Printing Music -- 12a Deluxe Music Construction Set, Version 2.0 (Geoff Brown)

Computer: Apple Macintosh
Printing device: Linotronics typesetter
Font: PostScript 'Sonata' by Adobe Systems
Vendor: Electronic Arts

Unreduced

CHORAL.

Soprano.
Flauto traverso in 8^a
Oboe d'amore, Violino I.
col Soprano.

Alto.
Violino II coll' Alto.

Tenore.
Viola col Tenore.

Basso.

Continuo.

Ob Denn sich's auliess, als wollt' er nicht, lass dich es nicht er - schre - cken; de - cken;

Ob Denn sich's auliess, als wollt' er nicht, lass dich es nicht er - schre - cken; de - cken;

Ob Denn sich's auliess, als wollt' er nicht, lass dich es nicht er - schre - cken; de - cken;

Ob Denn sich's auliess, als wollt' er nicht, lass dich es nicht er - schre - cken; de - cken;

Ob Denn sich's auliess, als wollt' er nicht, lass dich es nicht er - schre - cken; de - cken;

Illustration 40

Software for Printing Music -- 12b
Deluxe Music Construction Set, Version 2.0 (Geoff Brown)

Computer: Apple Macintosh
Printing device: Linotronics typesetter
Font: PostScript 'Sonata' by Adobe Systems
Vendor: Electronic Arts

Unreduced

The image displays a musical score for a piano piece, organized into two systems of staves. The left system consists of 8 staves, and the right system also consists of 8 staves. The music is written in treble and bass clefs, with various musical notations including notes, rests, and dynamic markings like 'dolce'. The notation is dense, with many notes and rests, suggesting a complex piece of music. The staves are connected by a single line, and the music is written in a standard musical notation style. The overall layout is clean and professional, typical of a high-quality musical score.

Illustration 41

Software for Music Printing -- 13a
High Score (Donald Byrd and Kimball Stickney)

Computer: Apple Macintosh
Printing device: Linotronics 100 typesetter
Font: PostScript 'Sonata' by Adobe Systems

Fourth String Quartet

BELA BARTOK

(1928)

I.

Allegro

Violino 1

Violino 2

Viola

Violoncello

The first system of the musical score for the Fourth String Quartet by Bela Bartok. It features four staves: Violino 1, Violino 2, Viola, and Violoncello. The time signature is 4/4. The key signature has one sharp (F#). The tempo is marked 'Allegro'. The first measure of each staff begins with a forte (f) dynamic. The Violoncello staff has a 3/4 time signature change in the second measure. The Viola staff has a 3/4 time signature change in the third measure. The system ends with a forte (f) dynamic in the Violoncello staff.

The second system of the musical score for the Fourth String Quartet by Bela Bartok. It features four staves: Violino 1, Violino 2, Viola, and Violoncello. The time signature is 4/4. The key signature has one sharp (F#). The system begins with a crescendo (cresc.) marking in the Violino 1 staff. The Violino 2 staff has a crescendo (cresc.) marking in the second measure. The Viola staff has a crescendo (cresc.) marking in the third measure. The Violoncello staff has a crescendo (cresc.) marking in the fourth measure. The system ends with a fortissimo (ff) dynamic in the Violoncello staff, followed by a crescendo (cresc.) marking.

Software for Music Printing -- 13b
High Score (Donald Byrd and Kimball Stickney)

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

BELA BARTOK
(1928)

Allegro

Allegro

4/4

f

f

f

Violino 2

Viola

Violoncello

The first system of the musical score for 'The Swan' from 'The Nutcracker' consists of four staves. The top two staves are for the Violin I and Violin II parts, both in treble clef. The bottom two staves are for the Viola and Cello/Double Bass parts, both in bass clef. The key signature is one flat (B-flat major or D minor), and the time signature is 3/4. The music begins with a 4-measure rest for all parts. The first staff (Violin I) has a crescendo marking and a sforzando (sf) marking. The second staff (Violin II) also has a crescendo marking and a sforzando (sf) marking. The third staff (Viola) has a crescendo marking and a sforzando (sf) marking. The fourth staff (Cello/Double Bass) has a crescendo marking and a fortissimo (ff) marking. The music features a mix of eighth and sixteenth notes, with some measures containing rests.

Illustration 43

Software for Printing Music -- 14 Oxford Music Processor (Richard Vendome)

Computer: IBM PC or compatible

Output device: Gould Colorwriter 6320

The musical score is presented in six systems, each with a treble and bass staff. The key signature is two flats (B-flat and E-flat), and the time signature is common time. The notation includes various musical symbols such as notes, rests, accidentals, and trills. The first system shows a treble staff with a melodic line and a bass staff with a supporting line. The second system continues the melody with some grace notes. The third system features a trill in the treble staff. The fourth system shows a more complex melodic line with many sixteenth notes. The fifth system has a trill in the treble staff. The sixth system concludes the piece with a final melodic flourish in the treble staff and a sustained bass line.

Illustration 44

Software for Printing Music -- 15
ETH (Giovanni Müller)

Hardware: LILITH workstation

Software: interactive editor in Modula-2 under development

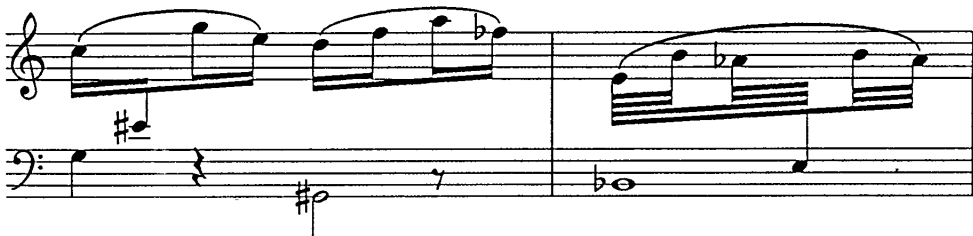
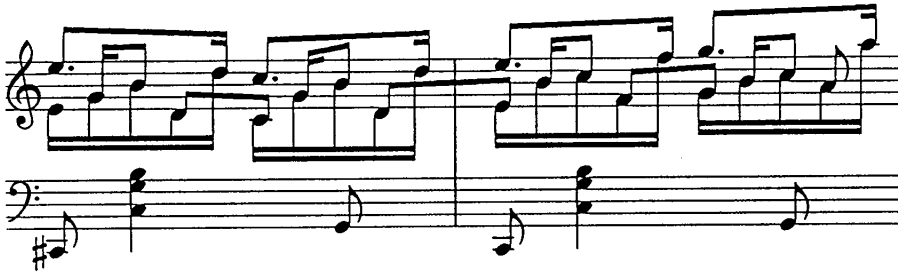


Illustration 45

Software for Printing Music -- 16
ALPHA/TIMES (Christoph Schnell)

Computer: Macintosh

Printing device: Apple ImageWriter II

Unreduced

Kyrie. Fons bonitatis pater ingenite

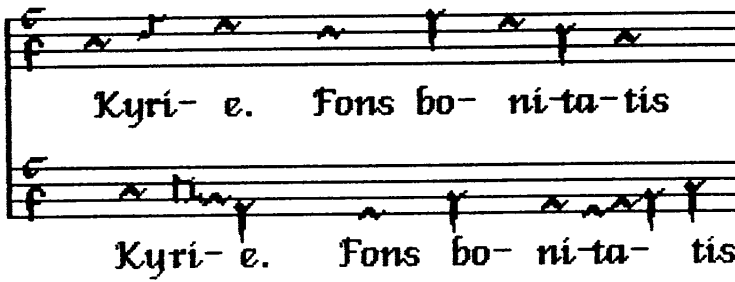


Illustration 46

Software for Printing Music -- 17 Interactive Music System (Lippold Haken, Kurt Hebel)

Computer: PLATO System

Printing device: Apple LaserWriter

Prélude

Tom Cortese

Moderato

The musical score for "Prélude" by Tom Cortese is presented in four systems. The key signature is G major (one sharp) and the time signature is 4/4. The tempo is marked "Moderato".

System 1: Treble staff begins with a piano (*p*) dynamic. The bass staff has a whole note chord.

System 2: Treble staff has a whole note chord. The bass staff has a whole note chord. A crescendo (*cresc*) marking is present.

System 3: Treble staff has a whole note chord. The bass staff has a whole note chord. A decrescendo (*decresc*) marking is present.

System 4: Treble staff has a whole note chord. The bass staff has a whole note chord. The score ends with a piano (*p*) dynamic.

An Early System for Printing Music: Jef Raskin's *Lingua Musica pro Machinationibus IV* (1966-67)

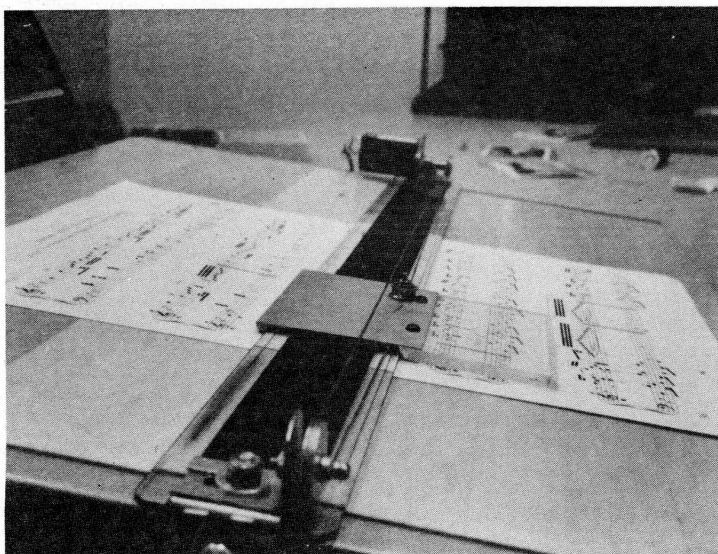
The recurrence of certain concepts in efforts to represent and print music is well illustrated by work done by Jef Raskin in the 1960's. Raskin had been involved as a high school student in the earliest phase of DARMS development. As a graduate student in computer science at Pennsylvania State University in 1966-67, he developed a *Lingua Musica pro Machinationibus* to support music printing. It was designed to represent music of arbitrary complexity and to reproduce it at any size. The printing program used vector graphics, with output from a Calcomp plotter.

Problems of positioning were resolved by specifying X and Y axis locations. A drafting system coordinated with a keypunch machine facilitated data entry. A screen display was also supported. The screen could display notation that looked the same as the printed output (the only photograph made of screen display is the one shown here).

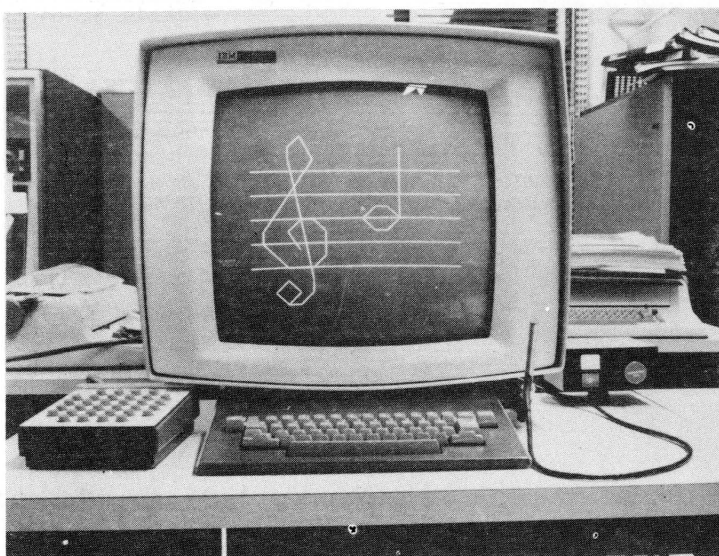
Raskin, a musician and conductor, subsequently gained recognition as a computer graphics artist, a reporter for *Byte Magazine*, and a designer of the Apple Macintosh. An important motivation in designing the Macintosh was, according to him, to make computer printing of music available inexpensively. Raskin is the founder and president of Information Appliance, Inc. The Center extends special thanks to Mr. Raskin for making available the following illustrations and other documents.



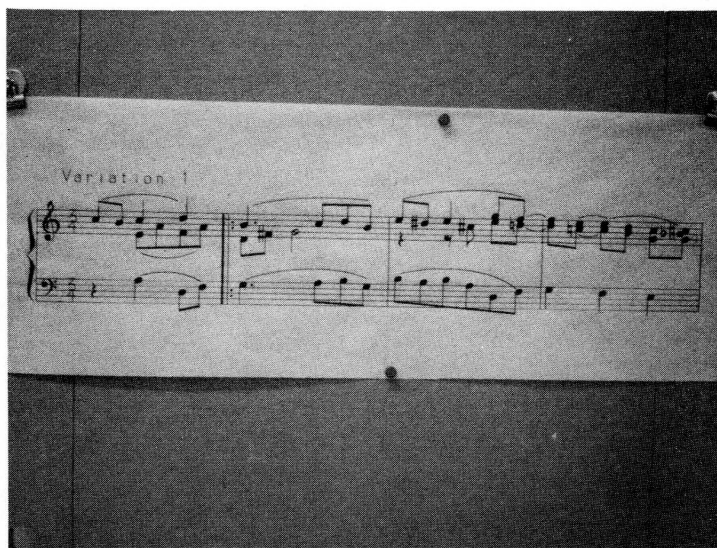
Karen Kalinsky entering the music of Bach onto punch cards using a combination of a keypunch machine and an X - Y graphics digitizer (shown in the following illustration).



Determination of X and Y coordinates.



Screen display (monitor for IBM mainframe).



Photograph of the first musical output.



Recent reproduction of the same material.



Another example from the same system.